UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Health and Safety
District C

Mount Hope, West Virginia
October 16, 1959

Memorandum

To: W. R. Park, District Supervisor

From: J. T. Whalen, Federal Coal-Mine Inspector and J. L. Gilley, Mining Health and Safety Engineer

Subject: Report on investigation of minor coal-mine bump, No. 9 mine, Jewell Eagle Coal Company, Melville, Logan County, West Virginia, September 22, 1959

A coal-mine bump in the 1 butt left section of the subject mine at 2:45 p.m., Tuesday, September 22, 1959, resulted in minor injuries to 4 employees. After receiving first-aid treatment underground they were taken to a hospital at Logan, West Virginia, for examination and treatment, and all except Thomas Harless, the Joy loading machine operator's helper, were released. Harless, who received a laceration on the forehead and mastoid to neck, was released the following day.

A company official notified the Bureau of Mines field office at Logan concerning the occurrence of the bump at 3:00 p.m., September 22, 1959, and an investigation was completed the following day. The investigation was made jointly by W. S. Robertson, company safety inspector, H. B. Rice, inspector-at-large and Harry Herald, district inspector, West Virginia Department of Mines, and the authors.

The No. 9 mine was opened by 2 slopes, one 840 feet in length and the other 1,080 feet in length, and is operated in the Eagle coal bed, which ranges from 42 to 60 inches in thickness, locally. A total of 162 men was employed, 37 on the surface and 125 underground, on 2 shifts a day, 3 to 5 days a week. The average daily production was 1,800 tons of coal, all loaded by 14 BU Joy loading machines into shuttle cars. This coal property is in the basin of Coalburg syncline and dips toward the basin about 3 percent northwest and out of the basin at a greater degree of inclination. The mine is gassy.

The last Federal inspection was completed August 11, 1959.

Copy to: Mr. Charles Walker, Vice President (1)
Mr. E. E. McBurney, General Manager (1)
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Localized dispositional changes in the immediate and in the main roof structure occur in many parts of the mine. In some areas, the coal is overlain by gray sandstone ranging from 15 to 60 feet in thickness; in other areas, the immediate roof consists of thinly bedded gray shales 12 to 30 inches in thickness overlain by beds of shaley sandstone and/or sandy shales ranging up to 15 feet thick. Logs of drill holes and an adjoining mining property indicate several sandstone beds ranging from 30 to 166.5 feet in thickness. Bed separation usually takes place at various horizons (depending upon the structure) above the coal bed following mining; this displacement with successive bending of overlying members likely results in a load equal to part of their weight being exerted on the coal in the working areas. Sloughing or squeezing of the coal along the ribs has been observed in the development as well as in the abutment zones of the pillar workings.

The mine floor is predominately hard, dense shale or siltstone, and some heaving was in evidence in the 1 butt left section. Heaving of the floor has been observed also in other parts of the mine on previous visits over a 10-year period.

The mine is developed by a multiple entry system, and pillar extraction is by a room-and-pillar system. The main entries, at present, are developed in groups of 6, but in the past were developed in groups of 4, 6, and 10. Butt entries are developed at various intervals in groups of 6, and room entries in groups of 6 (but in the past in groups of 3, 4, and 6) at intervals of about 200 feet. Entries are projected to be driven 20 feet wide on 60-foot centers and rooms 20 to 24 feet in width on 60-foot centers. Entry crosscuts are on 80-foot centers, and room crosscuts were normally on 60- and 80-foot centers; however, the distance between some of the crosscuts in the rooms involved, ranged from 60 to 90 feet.

Pillars are extracted by an open-end pocket system. Normally, pillaring is started as soon as a group of entries, such as the 1 butt left entries, has advanced the predetermined distance and rooms 1 to 5 at the top end of the panel completed by driving them abreast their projected distance of 200 feet or until they hole through into previously mined-out areas.

The system of development and extraction utilized in 1 butt left is shown in Sketch 2. The 1 butt left entry pillars were about 40 feet in width and 60 feet in length. The rooms involved were driven 20 to 30 feet in width, thus making the blocks (pillars) 30 to 40 feet in width and about 40 to 75 feet in length. The individual pillars are extracted by taking successive open-end lifts, 20 to 25 feet in width, across the back side of the pillars from the entry side of the entry chain pillars and from the room side of the room pillars; however, in some instances, the last lift (usually a push-out) is completed from the crosscut side of the pillars. After completion of the pillars in a panel of 5 rooms, the entry-chain pillars are extracted to a point opposite the No. 5 room then another panel of 5 rooms is developed, as illustrated in Sketch 2.

This system eventually establishes approximately a flat extraction line, but in the process development of rooms such as in the 1 butt left section is toward the gob in an abutment zone, and in some instances probably superimposed from 2 mined-out areas. (Old gob area from 2 butt left and the recently mined-out inby panel of rooms.)

The methods of roof support in the 1 butt left entries and rooms comprised roof-bolting and conventional timbering. Four 5/8-inch diameter expansion-type bolts, 42 inches in length, were installed vertically in rows on 4-foot centers longitudinally and transversely in the rooms and in the entries. Four or more bolts were installed close to the rib lines before crosscuts were turned. Bearing plates were of the embossed type, 6- by 6- by 1/4-inch in dimensions. The roof bolts were supplemented by a row of posts set with cap pieces and wedges on about 4-foot centers along each side of the roadways. The roof in pillar lifts was supported with 1 or more rows of posts set along each side of the roadways. Safety posts were required at the faces during the various mining cycles. Rows of breaker and turn timbers were set promptly before turning the pillar lifts. An excellent job of supporting the roof by prompt application and compliance was evident in the 1 butt left section. Affects of this and the previous bump (August 18) on the roof in the 1 butt left section definitely indicates the great importance of adequate roof support at all times. Although in each of these bumps the roof along the roadways in some of the rooms was affected more or less, and the fact that several of the timbers were broken and most of the roof bolts in the affected areas were subjected to greater stress, no injuries resulted from falls of roof material. The only roof that was detached or shaken down by the bump on September 22, was from induced cutters extending between the rib lines and the end bolts and timber lines in Nos. 1 and 2 rooms and the inby line of crosscuts connecting Nos. 3 and 6 rooms.

Development and extraction of the coal in the 2 butt left territory was completed during the period of November 1956 to October 1958; however, the specific location of the 2 butt left mined-out area into which the rooms of 1 butt left (those involved in the bump) holed through, was completed during September 1958 or about a year previously. Reportedly, several remnants of pillars were left unmined in 1 butt left, and 2 butt left; locations of some of these are indicated in Sketch 2.

The 1 butt left room panel barrier block had been reduced to 400 feet in length, and the last 6 rooms had been turned and were developed as indicated in Sketch 1, when the bump occurred. Location of the men and equipment is also shown in Sketch 1. It will be noted that the Nos. 1 and 2 rooms had holed through on the day of the bump into the old 2 butt left gob; and the second cut had been made in the No. 1 room pillar. Numbers 3 and 5 rooms lacked about 20 feet and Nos. 4 and 6 rooms lacked 30 to 40 feet of cutting into the 2 butt left goaf. At the time of the bump the faces of Nos. 3, 4, 5 and 6 rooms were cleaned up. The second cut had been made in the pillar lift in No. 1 room pillar and the cutting-machine crew had moved the cutting machine back to permit drilling the face preparatory to blasting.

The loading machine crew had been instructed to start a pillar lift in the No. 2 room pillar, as indicated in Sketch 1. They removed the timbers on the left side at the location where the lift was to be started, and according to the foreman, were loading the third shuttle car of coal along side of the pillar when the outburst occurred. The reaction of the outburst (stress wave) thrust the loading machine sidewise reportedly about 8 feet and approximately 12 to 15 tons of coal were thrown from the side of the pillar adjacent to the loading machine. The loading machine was the only equipment in operation in the face areas at the time the bump occurred. The 4 employees, none of whom were covered by the outrush of coal, evidently were injured by flying coal and/or by being thrown against the coal or equipment. The section foreman who was sitting on the right side of the roadway opposite the loading machine observing the loading operations, (See Sketch 1) was not injured.

Effects of the bump were evident in 5 of the 6 rooms, but the greatest forces, however, were concentrated in the area comprising the last inby pillars of Nos. 1 and 2 rooms, with the greatest forces being expended in the inby pillar of No. 2 room, causing cavities or spaces 4 to 6 inches in height extending as much as 6 feet within each side of the pillar. The shock from the ultimate failure of the No. 2 room pillar was sufficiently intense to cause coal to be expelled from the periphery of the inby pillars of Nos. 1, 2, and 3 rooms, as indicated in sketch 1.

Maximum cover over the coal at this property is about 1,500 feet, the topography is rugged with some of the higher mountains exceeding 900 feet in relief. The immediate area being mined was overlain with thickly bedded sandstone overlain by several beds of massive sandstone. It was further determined that the mine floor in the area involved was a hard, dense, sandy shale that resisted heaving. These salient factors undoubtedly had subjected certain portions of the large block being developed, particularly along the back side (gob side) to fairly high stresses that extended for considerable distance within the block. From sketch 1 it will be noted that 6 rooms, varying in width from 20 to 30 feet, were driven on 60-foot centers into the large block in the manner and direction indicated; furthermore, this development was being done toward an old gob area within the front abutment or into an area likely to be highly stressed by superimposed abutment loading from the gob areas of 1 butt left and 2 butt left, respectively.

Extraction of comparatively large blocks of coal, such as the 1 butt left block when stressed especially on 2 sides by superimposed abutment loading from gob areas and surrounded on the opposite sides by numerous small pillars in the presence of factors favorable for outbursts, can be hazardous even under controlled conditions. Numerous violent outbursts have occurred during the last 2 decades in attempting to mine such coal pillars by doing secondary development toward gob areas within stressed zones.

On the morning of September 2, 1959, following the investigation of the bump that occurred August 18, 1959, the authors met with mine superintendent, the general superintendent and the safety inspector in the mine superintendent's office and submitted a copy of the Bureau of Mines representative's recommendations for their information and consideration in mining similiar areas in the future. During the discussion, the authors emphasized the possibility of an outburst occurring if development or mining of the remaining portion of the 1 butt left block was conducted in a manner similar to that done in mining the preceeding panel of rooms. From sketch 1, it will be noted that the block as previously mentioned had been reduced to 400 feet in length, and its width for a distance of 275 feet ranged from 130 to 150 feet. The shape and the dimensions of the block in addition to other factors undoubtedly resulted in portions of the block, particularly the inby corner and for considerable distances within the block next to the 2 butt left gob area to become highly stressed. It is well to reiterate that the development of several rooms abreast (or even nearly abreast) in a stressed pillar block directly toward an old gob area in the presence of natural conditions favorable for bumps, is not in accordance with accepted practices to minimize occurrences of coal outbursts. Pillar mining in the presence of natural conditions favorable for outbursts requires that all precautions be taken through proper mining methods and practices to avoid critical areas and thus minimize the occurrence and severity of bumps.

The coal mine bump on September 22, was very similiar in nature to the one that occurred on August 18, in that each occurred on a pillar line point wherein the pillars were subjected to stresses or the loads from two superimposed abutment areas. In each instance, a group of rooms was developed toward the gob into a comparatively highly stressed coal pillar. The September 22 bump occurred while a loading machine was loading coal along the rib of a pillar preparatory to starting a lift across the back end, and the bump, in all probability, was triggered by stresses from precussion created by the loading arms of the loading machine penetrating or striking the coal pillar. Because of the similarity of these outbursts, some of the recommendations contained in the report on the bump on August 18 are included in this report.

It is the opinion of the authors that this minor coal-mine bump accident was the resultant of an accumulative process from a combination of the above-mentioned factors, and the recommendations made during this investigation include:

1. A system of mining should be adopted that will produce the least number of critical areas during retreat mining. Critical areas are produced by pillar line points, pillars not developed sufficiently in advance, improper sequence in development and extraction.

2. Under no circumstances, where the natural conditions are conducive to or favorable for outbursts, should groups of rooms (such as those involved) be driven or developed abreast into stressed areas of coal pillars (abutment pressure zone) toward the gob.

3. The mining system should require that coal pillars be developed as nearly uniform in shape and size as practicable.

4. Complete extraction should be striven for and pillar remnants should not be left. If it is not possible to recover such pillar remnants, their load-carrying capacity should be destroyed.

5. Pillars should be recovered in a straight line. Irregular pillar lines result in excessive pressures on the pillar line points. (Those jutting into the gobs.) Experience has shown, however, that the lead end (top end) of a pillar line can be kept slightly in advance.

6. Widths of roadways in rooms and entries, including crosscut openings, should be kept to the minimum required by the approved mining plan (entries - 20 feet, rooms - 20 to 24 feet). The adopted mining plans and practices should be complied with at all times.

7. Inducer shooting has proved beneficial in the mining of stressed pillars under controlled conditions and the method should be considered.

8. Loading (digging) coal with a loading machine from the ribs of stressed pillars, where conditions are favorable for bumps, should be discontinued.

The authors gratefully acknowledge the courtesy and cooperation of the employees and mine officials.

Respectfully submitted,

/s/ J. T. Whalen

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/s/ J. L. Gilley

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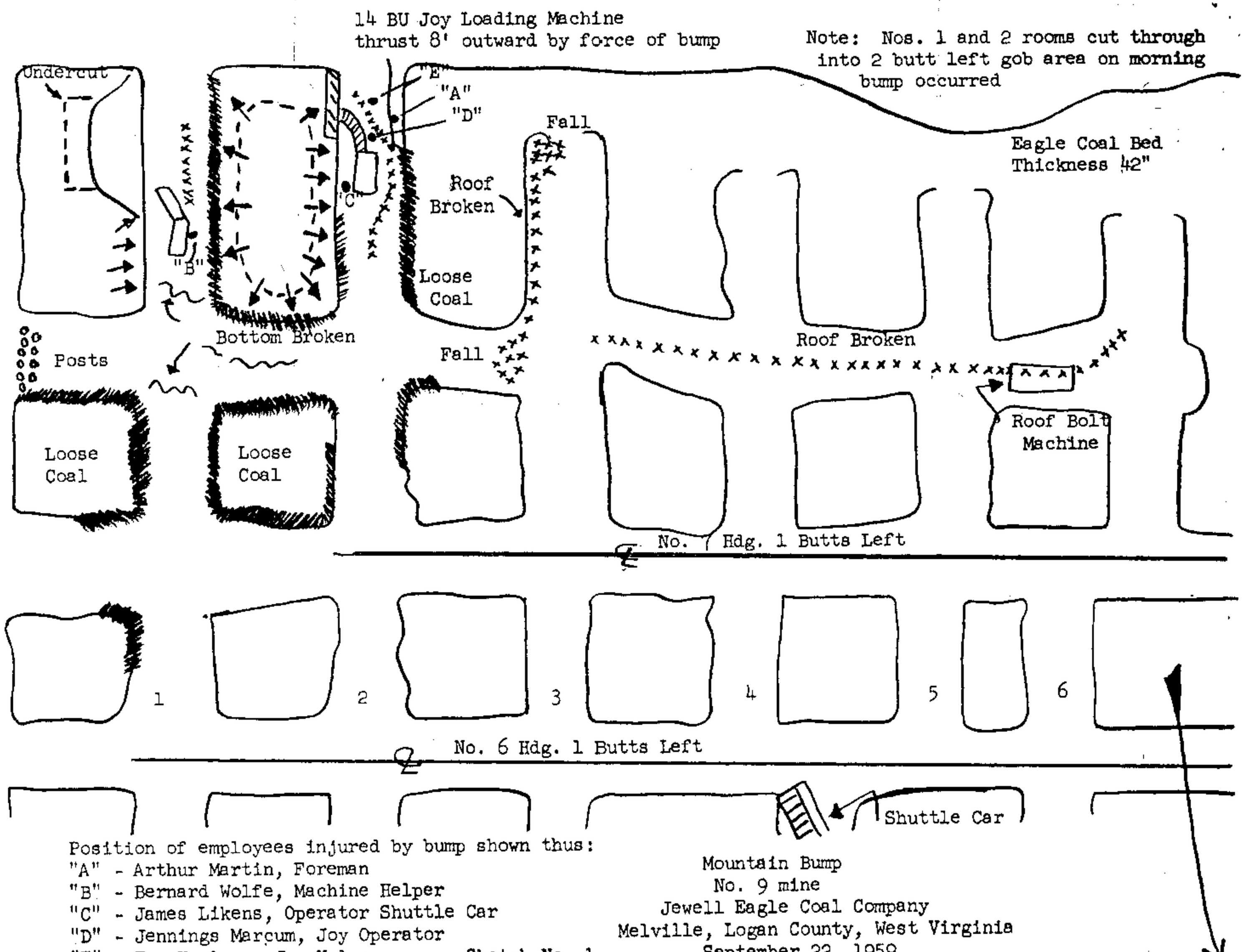
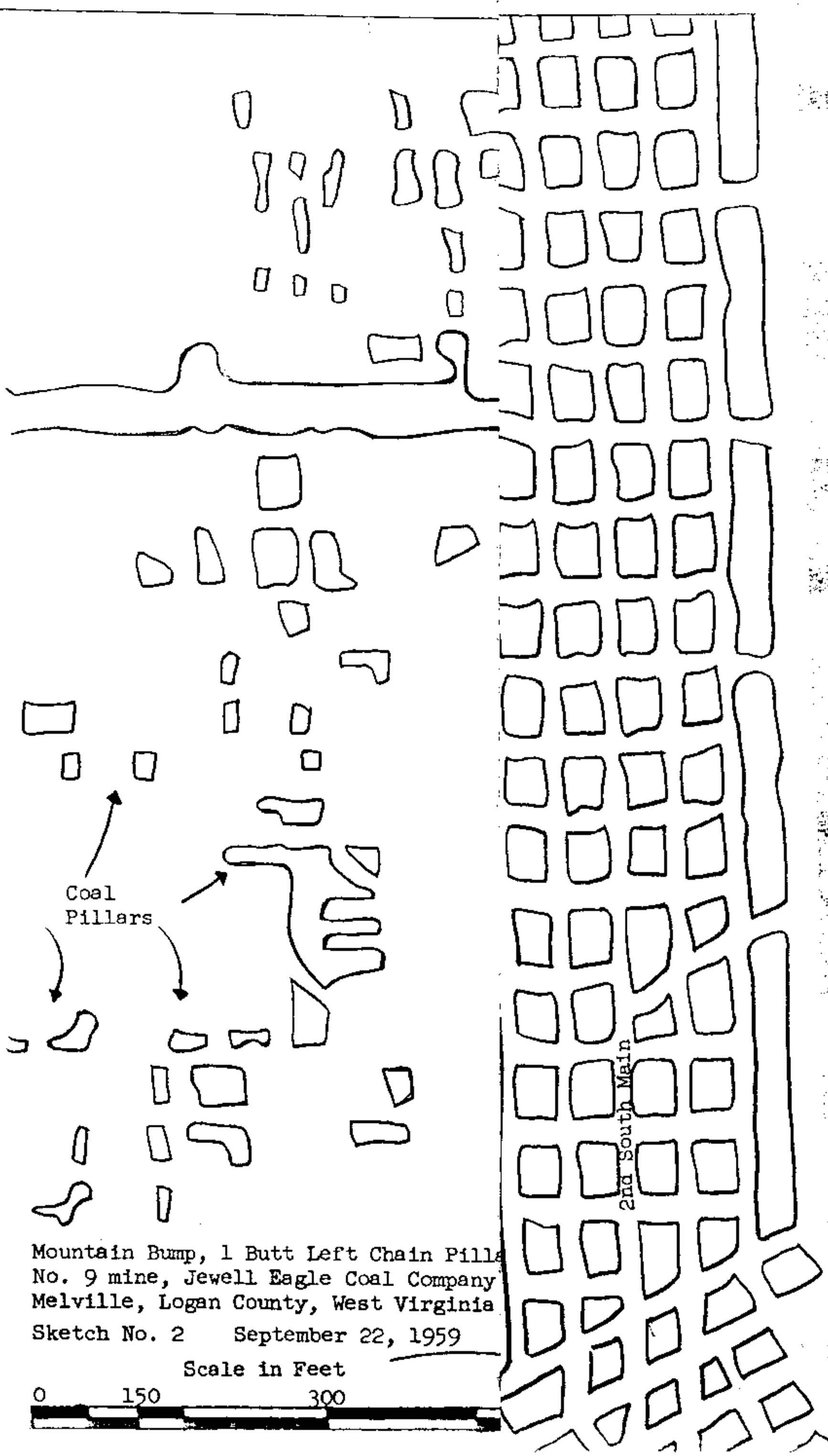


Position of employees injured by bump shown thus:
"A" - Arthur Martin, Foreman
"B" - Bernard Wolfe, Machine Helper
"C" - James Likens, Operator Shuttle Car
"D" - Jennings Marcum, Joy Operator
"E" - Tom Harless, Joy Helper

Sketch No. 1

Mountain Bump
No. 9 mine
Jewell Eagle Coal Company
Melville, Logan County, West Virginia
September 22, 1959



Mountain Bump, 1 Butt Left Chain Pilla
No. 9 mine, Jewell Eagle Coal Company
Melville, Logan County, West Virginia
Sketch No. 2 September 22, 1959

Scale in Feet

0 150 300

Eagle Coal Bed
Thickness 42"

Coal
Pillars

Mined Area

Bump 8-18-59

Bump
No. 2 Butt Left 9-22-59

Coal
Pillars

No. 1 Butt Left

1st South Main

2nd South Main

Mountain Bump, 1 Butt Left Chain Pillar
No. 9 mine, Jewell Eagle Coal Company
Melville, Logan County, West Virginia
Sketch No. 2 — September 22, 1959

Scale in Feet

0 150 300 600